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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/730,708	12/08/2003	Alex Nugent	1000-1214	3983

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EXAMINER	
COUGHLAN, PETER D	
ART UNIT	**PAPER NUMBER**
2129	

DATE MAILED: 11/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/730,708	NUGENT, ALEX	
	Examiner	Art Unit	
	Peter Coughlan	2129	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 September 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,6,7,9-21,23 and 24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,6,7,9-21,23 and 24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12/8/2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

1. This office action is in response to an AMENDMENT entered September 29, 2006 for the patent application 10/730708 filed on December 8, 2003.

2. The previous Office Action of July 19, 2006 is fully incorporated into this Non-Final Office Action by reference.

Status of Claims

3. Claims 1-3, 6, 7, 9-21, 23, 24 are pending.

Drawings

4. There needs to be drawing changes to explain the following

Claim 12 claims an integrator but there exists no diagram where this is to be placed among the physical neural network schematics.

Claim 19 claims a summation (circuit) but there exists no diagram where this is to be placed among the physical neural network schematics.

Claim 21 claims there exits a location where comparison occurs but there exists no diagram where this is to be placed among the physical neural network schematics.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-3, 6, 7, 9-21, 23, 24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The entire set of claims use at least one of the three terms 'nanoparticles', 'nanoconnections' and 'nanoconductors'. In some claims these are equivalent and can be interchanged with one another and in other claims one seems dependent upon another which contradicts the interchangeability of the three terms. Please review all the claims and make changes to reflect the invention and avoid ambiguous meanings or interpretations.

Claims 1, 2, 6, 9, 13, 23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. These claims contain the terms 'dielectric solution' and/or 'dielectric solvent'. In fact in claim 23 the 'dielectric solution' at the beginning of the claim turns into 'dielectric solvent' at the end of the claim. Please review all the claims and make changes to reflect the invention and avoid ambiguous meanings or interpretations.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 9, 10, 23, 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over McHardy et al in view of Nagahara, and further in view of Kaler. (U. S. Patent 5315162, referred to as **McHardy**; 'Directed placement of suspended carbon nanotubes', referred to as **Nagahara;** U. S. Patent Publication 20030048619, referred to as **Kaler**)

Claim 1

McHardy teaches providing an artificial physical neural network (**McHardy,** abstract) comprising at least one neuron and at least one synapse thereof. (**McHardy,** abstract; 'Neuron' of applicant is equivalent to 'metallic whisker' of McHardy. 'Synapse' of applicant is equivalent to 'synapse' of McHardy.)

McHardy does not teach wherein said at least one synapse is provided by a plurality of nanoconnections formed from a plurality of nanoconductors disposed and free to move about within a dielectric liquid solution in association with at least one pre-

synaptic electrode and at least one post-synaptic electrode thereof and an electric field applied thereof, wherein said dielectric solution comprises a mixture of a dielectric solvent and said plurality of nanoconductors.

Nagahara teaches wherein said at least one synapse is provided by a plurality of nanoconnections formed from a plurality of nanoconductors (**Nagahara,** abstract; 'Nanoconductors' of applicant is equivalent to 'nanotubes' of Nagahara.) disposed and free to move about within a dielectric liquid solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode (**Nagahara,** abstract, p3827, C2:9-22; 'One pre-synaptic electrode' and 'one post-synaptic electrode' of applicant is equivalent to 'electrodes' of Nagahara. 'Dielectric solution' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara.) thereof and an electric field applied thereof, wherein said dielectric solution comprises a mixture of a dielectric solvent and said plurality of nanoconductors. (**Nagahara,** abstract; 'Electric field applied' of applicant is equivalent to 'ac bias is applied' of Nagahara.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of McHardy by using nanoparticles for connection between electrodes as taught by Nagahara to have at least one synapse is provided by a plurality of nanoconnections formed from a plurality of nanoconductors disposed and free to move about within a dielectric liquid solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode thereof and an electric field applied thereof, wherein said dielectric solution comprises a mixture of a dielectric solvent and said plurality of nanoconductors.

For the purpose of generating connections between electrodes as needed.

McHardy and Nagahara do not teach locating said dielectric liquid solution within a connection gap formed between said at least one pre-synaptic electrode and said at least one post-synaptic electrode, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not utilized by said artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said artificial physical neural network are strengthened; and transmitting at least one pulse generated from said at least one neuron to said at least one post-synaptic electrode of said at least one neuron and said at least one pre-synaptic electrode of said at least one neuron of said physical neural network, thereby strengthening at least one nanoconnection of said plurality of nanoconnections disposed within said dielectric liquid solution and strengthening said at least one synapse thereof.

Kaler teaches locating said dielectric liquid solution within a connection gap formed between said at least one pre-synaptic electrode and said at least one post-synaptic electrode, wherein each nanoconnection among said plurality of nanoconnections is

strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not utilized by said artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said artificial physical neural network are strengthened (**Kaler,** abstract; 'Nanoconnections is strengthened or weakened according to an application of said electric field' of applicant is equivalent to 'conductance and their thickness, conductivity, and fractal dimension can be controlled by varying the frequency and voltage of the applied field' of Kaler.); and transmitting at least one pulse generated from said at least one neuron to said at least one post-synaptic electrode of said at least one neuron and said at least one pre-synaptic electrode of said at least one neuron of said physical neural network, thereby strengthening at least one nanoconnection of said plurality of nanoconnections disposed within said dielectric liquid solution and strengthening said at least one synapse thereof. (**Kaler,** abstract; 'Transmitting at least one pulse' of applicant is equivalent to 'alternating current' of Kaler. If the 'pulse' is greater than previous pulses the nanoconnection will be strengthen.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy and Nagahara by being able to increase or

decrease the conductivity as taught by Kaler to locating said dielectric liquid solution within a connection gap formed between said at least one pre-synaptic electrode and said at least one post-synaptic electrode, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not utilized by said artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said artificial physical neural network are strengthened; and transmitting at least one pulse generated from said at least one neuron to said at least one post-synaptic electrode of said at least one neuron and said at least one pre-synaptic electrode of said at least one neuron of said physical neural network, thereby strengthening at least one nanoconnection of said plurality of nanoconnections disposed within said dielectric liquid solution and strengthening said at least one synapse thereof.

For the purpose employing electrical fields to generate connections and conductivity between electrodes and using these selectable and adjustable properties to construct a neural network.

Claim 2

McHardy and Nagahara do not teach increasing said electrical frequency of said electric field applied to said at least one pre-synaptic electrode and said at least one post-synaptic electrode, in response to generating said at least one pulse said at least one neuron, thereby strengthening at least one nanoconnection of said plurality of nanoconnections disposed within said dielectric liquid. solution and strengthening said at least one synapse thereof.

Kaler teaches increasing said electrical frequency of said electric field applied to said at least one pre-synaptic electrode and said at least one post-synaptic electrode, in response to generating said at least one pulse said at least one neuron, thereby strengthening at least one nanoconnection of said plurality of nanoconnections disposed within said dielectric liquid. solution and strengthening said at least one synapse thereof. (**Kaler,** abstract; 'Nanoconnections is strengthened or weakened according to an application of said electric field' of applicant is equivalent to 'conductance and their thickness, conductivity, and fractal dimension can be controlled by varying the frequency and voltage of the applied field' of Kaler. Therefore Kaler demonstrates by varying electrical frequency the connection will be srenghten.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings McHardy and Nagahara by employing the characteristics of adjusting the conductivity as taught by Kaler to have increasing said electrical frequency of said electric field applied to said at

least one pre-synaptic electrode and said at least one post-synaptic electrode, in response to generating said at least one pulse said at least one neuron, thereby strengthening at least one nanoconnection of said plurality of nanoconnections disposed within said dielectric liquid solution and strengthening said at least one synapse thereof.

For the purpose employing electrical fields to generate connections and conductivity between electrodes and using these selectable and adjustable properties to construct a neural network.

Claim 3

McHardy teaches forming a connection network within said connection gap from said plurality of nanoconnections by applying said electric field across said connection gap to said at least one pre-synaptic electrode and said at least one post-synaptic electrode associated with said plurality of nanoconnections. (**McHardy,** C6:67 through C7:5; 'Connection network' of applicant is equivalent to 'neural networks having many synaptic junctions' of McHardy.)

Claim 9

McHardy teaches configuring an adaptive artificial physical neural network (**McHardy,** abstract, C4:55-68; 'Adaptive' of applicant means 'which can be formed from a plurality of interconnected nanoconnections or nanoconnectors' is equivalent to 'growth of CAF' and 'redissolves the CAF' of McHardy.) to comprise a connection

network (**McHardy,** abstract; 'Connection network' of applicant is equivalent to 'neural network' of McHardy.)

McHardy does not teach comprising a plurality of nanoconnections formed from a dielectric liquid solution comprising a mixture of a dielectric solvent and a plurality of nanoconductors, said plurality of nanoconductors located and free to move about within said a dielectric liquid solution, wherein said plurality of nanoconductors experiences an alignment with respect to an applied electric field to form said a connection network thereof, such that said adaptive physical neural network comprises a plurality of neurons interconnected by said a plurality of nanoconnections.

Nagahara teaches comprising a plurality of nanoconnections (**Nagahara,** abstract; 'Nanoconnections' of applicant is accomphished by 'nanotubes' of Nagahara.) formed from a dielectric liquid solution(**Nagahara,** p3827, C2:9-22; 'Dielectric solution' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara.) comprising a mixture of a dielectric solvent and a plurality of nanoconductors, said plurality of nanoconductors located and free to move about within said a dielectric liquid solution, wherein said plurality of nanoconductors experiences an alignment with respect to an applied electric field to form said a connection network thereof, such that said adaptive physical neural network comprises a plurality of neurons interconnected by said a plurality of nanoconnections. (**Nagahara,** abstract, p3827, C2:9-22; 'One pre-synaptic electrode' and 'one post-synaptic electrode' of applicant is equivalent to 'electrodes' of Nagahara. 'Dielectric solution' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara. 'Applied electrical field' of applicant is

equivalent to 'ac bias is applied' of Nagahara.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of McHardy by using nanoparticles for connections between electrodes as taught by Nagahara to have a plurality of nanoconnections formed from a dielectric liquid solution comprising a mixture of a dielectric solvent and a plurality of nanoconductors, said plurality of nanoconductors located and free to move about within said a dielectric liquid solution, wherein said plurality of nanoconductors experiences an alignment with respect to an applied electric field to form said a connection network thereof, such that said adaptive physical neural network comprises a plurality of neurons interconnected by said a plurality of nanoconnections.

For the purpose of generating connections between electrodes only when needed or required.

McHardy and Nagahara do not teach locating said dielectric liquid solution within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode of said adaptive artificial physical neural network, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network thereof becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not utilized by said adaptive artificial physical neural network are dissolved

back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said adaptive artificial physical neural network are strengthened; providing an increased frequency of said applied electric field to strengthen said plurality of nanoconnections within said adaptive physical neural network regardless of a network topology thereof.

Kaler teaches locating said dielectric liquid solution within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode of said adaptive artificial physical neural network, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network thereof becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not utilized by said adaptive artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said adaptive artificial physical neural network are strengthened; providing an increased frequency of said applied electric field to strengthen said plurality of nanoconnections within said adaptive physical neural network regardless of a network topology thereof. (**Kaler,** abstract; 'Nanoconnections is strengthened or weakened according to an application of said electric field' of applicant is equivalent to 'conductance and their thickness,

conductivity, and fractal dimension can be controlled by varying the frequency and voltage of the applied field' of Kaler.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy and Nagahara by being able to adjust the thickness of the connections between the electrodes as taught by Kaler to have locating said dielectric liquid solution within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode of said adaptive artificial physical neural network, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network thereof becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not utilized by said adaptive artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said adaptive artificial physical neural network are strengthened; providing an increased frequency of said applied electric field to strengthen said plurality of nanoconnections within said adaptive physical neural network regardless of a network topology thereof.

For the purpose of selectivity forming (pruning) a neural network.

Claim 10

McHardy teaches providing at least one output from at least one neuron of said plurality of neurons to an input of another neuron of said adaptive physical neural network. (**McHardy,** abstract, C4:55-68; 'Adaptive' of applicant means 'which can be formed from a plurality of interconnected nanoconnections or nanoconnectors' is equivalent to 'growth of CAF' and 'redissolves the CAF' of McHardy.'Output of applicant is equivalent to 'output' of HcHardy.)

Claim 23

McHardy does not teach a dielectric liquid solution comprising a mixture of a dielectric solvent and a plurality of nanoconductors; at least one neuron and at least one synapse thereof, wherein said at least one synapse is configured from a plurality of nanoconnections formed from a plurality of nanoconductors disposed and free to move about within said dielectric liquid solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode thereof and an electric field applied thereof; a connection gap formed between said between said at least one pre-synaptic electrode and said at least one post-synaptic electrode, wherein said liquid dielectric solution is located within said connection gap.

Nagahara teaches a dielectric liquid solution comprising a mixture of a dielectric solvent and a plurality of nanoconductors (**Nagahara,** abstract, , p3827, C2:9-22;; 'Nanoconductors' of applicant is equivalent to 'nanotubes' of Nagahara. 'Dielectric solution' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara.); at least one neuron and at least one synapse thereof, wherein said at least

one synapse is configured from a plurality of nanoconnections formed from a plurality of nanoconductors disposed and free to move about within said dielectric liquid solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode thereof and an electric field applied thereof(**Nagahara,** abstract, p3827, C2:9-22; 'One pre-synaptic electrode' and 'one post-synaptic electrode' of applicant is equivalent to 'electrodes' of Nagahara. 'Dielectric slution' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara. 'One pre-synaptic electrode' and 'one post-synaptic electrode' of applicant is equivalent to 'electrodes' of Nagahara. 'Electric field applied' of applicant is equivalent to 'ac bias is applied' of Nagahara. 'Neuron' of applicant is equivalent to 'nanoscale wiring' of Nagahara.); a connection gap formed between said between said at least one pre-synaptic electrode and said at least one post-synaptic electrode, wherein said liquid dielectric solution is located within said connection gap. (**Nagahara,** abstract, p3827, C2:9-22; 'One pre-synaptic electrode' and 'one post-synaptic electrode' of applicant is equivalent to 'electrodes' of Nagahara. 'Dielectric solution' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of McHardy by introducing components needed for the physical neural network and how they work as taught by Nagahara to have a dielectric liquid solution comprising a mixture of a dielectric solvent and a plurality of nanoconductors; at least one neuron and at least one synapse thereof, wherein said at least one synapse is configured from a plurality of nanoconnections formed from a plurality of nanoconductors disposed and free to move

about within said dielectric liquid solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode thereof and an electric field applied thereof; a connection gap formed between said between said at least one pre-synaptic electrode and said at least one post-synaptic electrode, wherein said liquid dielectric solution is located within said connection gap.

For the purpose of establishing a base from which to construct a neural network.

McHardy and Nagahara do not teach wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger.

Kaler teaches wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger (**Kaler,** abstract; 'Nanoconnections is strengthened or weakened according to an application of said electric field' of applicant is equivalent to 'conductance and their thickness, conductivity, and fractal dimension can be controlled by varying the frequency and voltage of the applied field' of Kaler.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy and Nagahara by being able to alter the thickness of the

connections as taught by Kaler to have each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger.

For the purpose of being able to alter the connections of the neural network so it can be adaptive

McHardy teaches adaptive artificial physical neural network(**McHardy,** abstract, C4:55-68; 'Adaptive' of applicant means 'which can be formed from a plurality of interconnected nanoconnections or nanoconnectors' is equivalent to 'growth of CAF' and 'redissolves the CAF' of McHardy.)

McHardy and Nagahara do not teach thereof becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not utilized by said adaptive artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said adaptive artificial physical neural network are strengthened and pulse generation means for generating at least one pulse from said at least one neuron to said at least one post-synaptic electrode of said at least one neuron and said at least one pre-synaptic electrode of said at least one neuron of said physical neural network, thereby strengthening at least one nanoconnection among said plurality of nanoconnections disposed within said dielectric liquid solution and strengthening said at least one synapse thereof.

Kaler teaches thereof becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not utilized by said adaptive artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said adaptive artificial physical neural network are strengthened (**Kaler,** abstract; 'Utilized more' of applicant would indicate an increase of voltage or frequency thus strengthening the connection. 'Not utilized' of applicant would indicate a decrease of voltage or frequency thus dissolving back the connection.) and pulse generation means for generating at least one pulse from said at least one neuron to said at least one post-synaptic electrode of said at least one neuron and said at least one pre-synaptic electrode of said at least one neuron of said physical neural network, thereby strengthening at least one nanoconnection among said plurality of nanoconnections disposed within said dielectric liquid solution and strengthening said at least one synapse thereof. (**Kaler,** abstract; 'Nanoconnections is strengthened or weakened according to an application of said electric field' of applicant is equivalent to 'conductance and their thickness, conductivity, and fractal dimension can be controlled by varying the frequency and voltage of the applied field' of Kaler. Therefore if a neuron is used the electrical field would increase thus improving the conductance and thickness.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy and Nagahara by having the ability to alter the conductivity of the connections as taught by Kaler to have nanoconnections among said plurality of nanoconnections

that are not strengthened and thus not utilized by said adaptive artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said adaptive artificial physical neural network are strengthened and pulse generation means for generating at least one pulse from said at least one neuron to said at least one post-synaptic electrode of said at least one neuron and said at least one pre-synaptic electrode of said at least one neuron of said physical neural network, thereby strengthening at least one nanoconnection among said plurality of nanoconnections disposed within said dielectric liquid solution and strengthening said at least one synapse thereof.

For the purpose of having an trainable and adaptive neural network.

Claim 24

McHardy teaches a connection network formed from said plurality of nanoconnections by applying said electric field to said at least one pre-synaptic electrode and said at least one post-synaptic electrode associated with said plurality of nanoconnections. (**McHardy,** C6:67 through C7:5, C4:21-30; 'Connection network' of applicant is equivalent to 'neural networks havinf many synaptic junctions' of McHardy. In this art the nanoconnections are the connections between the copper ions)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 6, 7, 11-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of McHardy, Nagahara and Kaler as set forth above in view of Nugent (U. S. Patent Publication 20030177450, referred to as **Nugent**)

Claim 6

McHardy teaches providing an artificial a physical neural network (**McHardy,** abstract) comprising a plurality of neurons (**McHardy,** abstract; 'Neuron' of applicant is equivalent to 'metallic whisker' of McHardy.)

McHardy does not teach formed from a plurality of nanoconnections formed from a dielectric liquid solution comprising a mixture of a dielectric solution comprising a mixture of a dielectric solvent and a plurality of nanoconductors, said plurality of nanoconductors disposed and free to move about within said a dielectric liquid solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode.

Nagahara teaches formed from a plurality of nanoconnections (**Nagahara,** abstract; 'Nanoconnections' of applicant is accomplished by 'nanotubes' of Nagahara.) formed from a dielectric liquid solution comprising a mixture of a dielectric solution comprising a mixture of a dielectric solvent (**Nagahara,** p3827, C2:9-22; 'Dielectric solution' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara.) and a plurality of nanoconductors, said plurality of nanoconductors disposed and free to move about within said a dielectric liquid solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode. (**Nagahara,** abstract, p3827, C2:9-22; 'One pre-synaptic electrode' and 'one post-synaptic electrode' of applicant is equivalent to 'electrodes' of Nagahara. 'Dielectric solution' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of McHardy by introducing the formation of connections between electrodes by nanoconnections as taught by Nagahara to have a plurality of nanoconnections formed from a dielectric liquid solution comprising a mixture of a dielectric solution comprising a mixture of a dielectric solvent and a plurality of nanoconductors, said plurality of nanoconductors disposed and free to move about within said a dielectric liquid solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode.

For the purpose of establishing a basis for a physical neural network.

McHardy and Nagahara do not teach locating said dielectric liquid solution within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode of said artificial physical neural network, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network thereof becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not utilized by said artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said artificial physical neural network are strengthened.

Kaler teaches locating said dielectric liquid solution within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode of said artificial physical neural network, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network thereof becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not

utilized by said artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said artificial physical neural network are strengthened. (**Kaler,** abstract; 'Nanoconnections is strengthened or weakened according to an application of said electric field' of applicant is equivalent to 'conductance and their thickness, conductivity, and fractal dimension can be controlled by varying the frequency and voltage of the applied field' of Kaler.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy and Nagahara by being able to alter the conductivity of the connections as taught by Kaler to have locating said dielectric liquid solution within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode of said artificial physical neural network, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network thereof becomes, and wherein nanoconnections among said plurality of nanoconnections that are not strengthened and thus not utilized by said artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said artificial physical neural network are strengthened.

For the purpose of obtaining a adaptive and trainable physical neural network.

McHardy, Nagahara and Kaler do not teach activating a subsequent neuron in response to firing an initial neuron of said plurality of neurons, thereby increasing a voltage of a pre-synaptic electrode of said neuron, which causes a refractory pulse thereof to decrease a voltage of a post-synaptic electrode associated with said neuron and thus provides an increased voltage between said pre-synaptic electrode of said preceding neurons and said post-synaptic electrode of said neuron.

Nugent teaches activating a subsequent neuron in response to firing an initial neuron of said plurality of neurons, thereby increasing a voltage of a pre-synaptic electrode of said neuron, which causes a refractory pulse thereof to decrease a voltage of a post-synaptic electrode associated with said neuron and thus provides an increased voltage between said pre-synaptic electrode of said preceding neurons and said post-synaptic electrode of said neuron. (**Nugent,** ¶0108; 'Increasing a voltage of a pre-synaptic electrode' of applicant is accomplished by the 'amplifier' of Nugent.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy, Nagahara and Kaler by causing a 'refractory pulse' which decreases the post-synaptic electrode as taught by Nugent to have a activating a subsequent neuron in response to firing an initial neuron of said plurality of neurons, thereby increasing a voltage of a pre-synaptic electrode of said neuron, which causes a refractory pulse thereof to decrease a voltage of a post-synaptic electrode associated with said neuron and thus provides an

increased voltage between said pre-synaptic electrode of said preceding neurons and said post-synaptic electrode of said neuron.

For the purpose of resetting the neuron back to its original state due to the fact that after a neuron fires more nanoparticles will be attracted to the connection thus altering its characteristics and a means is needed to reset the neuron back to its original setting.

Claim 7

McHardy and Naghara do not teach firing and activating subsequent neurons thereof in succession in order to produce an increased frequency of said electric field between subsequent pre-synaptic and post-synaptic electrodes thereof, thereby causing an increase in an alignment of at least one nanoconnection of said plurality of nanoconnections and a decrease in an electrode resistance between said subsequent pre-synaptic and post-synaptic electrodes thereof.

Kaler teaches firing and activating subsequent neurons thereof in succession in order to produce an increased frequency of said electric field between subsequent pre-synaptic and post-synaptic electrodes thereof, thereby causing an increase in an alignment of at least one nanoconnection of said plurality of nanoconnections and a decrease in an electrode resistance between said subsequent pre-synaptic and post-synaptic electrodes thereof. (**Kaler,** abstract; 'Nanoconnections is strengthened or weakened according to an application of said electric field' of applicant is equivalent to 'conductance and their thickness, conductivity, and fractal dimension can be

controlled by varying the frequency and voltage of the applied field' of Kaler. By firing the neuron would have the parallel effect as the electric field does by increasing conductance and thickness.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy and Naghara by being able to alter the thickness of the connection between the electrodes as taught by Kaler to have firing and activating subsequent neurons thereof in succession in order to produce an increased frequency of said electric field between subsequent pre-synaptic and post-synaptic electrodes thereof, thereby causing an increase in an alignment of at least one nanoconnection of said plurality of nanoconnections and a decrease in an electrode resistance between said subsequent pre-synaptic and post-synaptic electrodes thereof.

For the purpose of obtaining a adaptive and trainable physical neural network.

Claim 11

McHardy, Nagahara and Kaler do not teach automatically summing at least one signal provided by said connection network via at least one neuron of said adaptive physical neural network to provide a summation value thereof; comparing said summation value to a threshold value and emitting a pulse if a current activation state exceeds said threshold value; and automatically grounding or lowering to -Vcc a post synaptic junction associated with said at least one neuron during emission of said pulse, thereby causing at least one synapse in receipt of a pre-synaptic activation to experience an increase in a local electric field, such that at least one synapse that

contributes to an activation of said at least one neuron experiences an increase in said local electric field parallel to a connection direction associated with said connection network and additionally experiences a higher frequency of activation in order to increase a strength of said plurality of nanoconnections.

Nugent teaches automatically summing at least one signal provided by said connection network via at least one neuron of said adaptive physical neural network to provide a summation value thereof(**Nugent,** ¶0108; 'Provide a summation value' of applicant is equivalent to 'temporal summation within a neuron' of Nugent.); comparing said summation value to a threshold value and emitting a pulse if a current activation state exceeds said threshold value(**Nugent,** ¶0108; 'Summation value' of applicant is equivalent to 'input of node B' of Nugent. 'Threshold value' of applicant is equivalent to 'input of node A' of Nugent.); and automatically grounding or lowering to -Vcc a post synaptic junction associated with said at least one neuron during emission of said pulse, thereby causing at least one synapse in receipt of a pre-synaptic activation to experience an increase in a local electric field, such that at least one synapse that contributes to an activation of said at least one neuron experiences an increase in said local electric field parallel to a connection direction associated with said connection network and additionally experiences a higher frequency of activation in order to increase a strength of said plurality of nanoconnections. (**Nugent,** ¶0108; 'Grounding or lowering to –Vcc a post-synaptic junction' of applicant is equivalent to item 1108 in ¶0108 or Figure 11 of Nugent.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of

McHardy, Nagahara and Kaler by using a ground between a pre-synaptic and post-synaptic junction as taught by Nugent to have automatically summing at least one signal provided by said connection network via at least one neuron of said adaptive physical neural network to provide a summation value thereof; comparing said summation value to a threshold value and emitting a pulse if a current activation state exceeds said threshold value; and automatically grounding or lowering to -Vcc a post synaptic junction associated with said at least one neuron during emission of said pulse, thereby causing at least one synapse in receipt of a pre-synaptic activation to experience an increase in a local electric field, such that at least one synapse that contributes to an activation of said at least one neuron experiences an increase in said local electric field parallel to a connection direction associated with said connection network and additionally experiences a higher frequency of activation in order to increase a strength of said plurality of nanoconnections.

For the purpose of finding combined results of neurons and nullifying the results of firing neurons to the characteristics of the neuron.

Claim 12

McHardy, Nagahara and Kaler do not teach at least one neuron of said artificial physical neural network comprises an integrator.

Nugent teaches at least one neuron of said artificial physical neural network comprises an integrator. (**Nugent,** ¶0054 and item 1110 Figure 11; 'Integrator' of applicant is equivalent to 'amplifier' of Nugent.) It would have been obvious to a person

having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy, Nagahara and Kaler by introducing an integrator as taught by Nugent to have at least one neuron of said artificial physical neural network comprises an integrator.

For the purpose of comparing an input value to a threshold value.

Claim 13

McHardy teaches providing an artificial a physical neural network (**McHardy,** abstract) comprising a plurality of neurons connected via a connection network (**McHardy,** abstract; 'Connection network' of applicant is equivalent to 'neural network' of McHardy. 'Neuron' of applicant is equivalent to 'metallic whiskers' of McHardy.)

McHardy does not teach a plurality of nanoconnections formed from a dielectric liquid solution comprising a mixture of plurality of nanoconductors and a dielectric solvent, wherein said plurality of nanoconductors is disposed and free to move about within said a dielectric liquid solution to form said connection network wherein said plurality of nanoconnections transfers signals.

Nagahara teaches a plurality of nanoconnections (**Nagahara,** abstract; 'Nanoconnections' of applicant is accomphished by 'nanotubes' of Nagahara.) formed from a dielectric liquid solution (**Nagahara,** abstract, p3827, C2:9-22; 'One pre-synaptic electrode' and 'one post-synaptic electrode' of applicant is equivalent to 'electrodes' of Nagahara. 'Dielectric solution' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara.) comprising a mixture of plurality of nanoconductors and

a dielectric solvent, wherein said plurality of nanoconductors is disposed and free to move about within said a dielectric liquid solution to form said connection network wherein said plurality of nanoconnections transfers signals. (**Nagahara,** abstract, p3827, C2:9-22; 'One pre-synaptic electrode' and 'one post-synaptic electrode' of applicant is equivalent to 'electrodes' of Nagahara. 'Dielectric solution' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara. 'Applied electrical field' of applicant is equivalent to 'ac bias is applied' of Nagahara. 'nanoconnections transfers signals' of applicant is accomplished by 'nanoscale wiring' of Nagahara.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of McHardy by illustrating how nanoconductors are made into a connective link between electrodes as taught by Nagahara to have a plurality of nanoconnections formed from a dielectric liquid solution comprising a mixture of plurality of nanoconductors and a dielectric solvent, wherein said plurality of nanoconductors is disposed and free to move about within said a dielectric liquid solution to form said connection network wherein said plurality of nanoconnections transfers signals.

For the purpose of having a basis for a physical neural network.

McHardy and Nagahara do not teach locating said dielectric liquid solution within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode of said adaptive artificial physical neural network, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical

frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network thereof becomes, and wherein nanoconnectiqns among said plurality of nanoconnections that are not strengthened and thus not utilized by said adaptive artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said adaptive artificial physical neural network are strengthened.

Kaler teaches locating said dielectric liquid solution within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode of said adaptive artificial physical neural network, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network thereof becomes, and wherein nanoconnectiqns among said plurality of nanoconnections that are not strengthened and thus not utilized by said adaptive artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said adaptive artificial physical neural network are strengthened. (**Kaler,** abstract; 'Nanoconnections is strengthened or weakened according to an application of said electric field' of applicant is equivalent

to 'conductance and their thickness, conductivity, and fractal dimension can be controlled by varying the frequency and voltage of the applied field' of Kaler.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy and Nagahara by being able to control the thickness of the connection between the electrodes as taught by Kaler to have locating said dielectric liquid solution within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode of said adaptive artificial physical neural network, wherein each nanoconnection among said plurality of nanoconnections is strengthened or weakened according to an application of said electric field, such that the greater an electrical frequency or an amplitude of said electric field, the more nanoconductors among said plurality of nanoconductors align to form said plurality of nanoconnections and the stronger said artificial physical neural network thereof becomes, and wherein nanoconnectiqns among said plurality of nanoconnections that are not strengthened and thus not utilized by said adaptive artificial physical neural network are dissolved back into said dielectric liquid solution and nanoconnections among said plurality of nanoconnections that are utilized more frequently by said adaptive artificial physical neural network are strengthened.

For the purpose of having a adaptive physical neural network that is trainable and flexible.

McHardy, Nagahara and Kaler do not teach presenting an input data set to said artificial physical neural network to produce at least one output thereof and increasing

network activity within said artificial physical neural network until said at least one output changes to a desired output.

Nugent teaches presenting an input data set to said artificial physical neural network to produce at least one output thereof (**Nugent,** ¶0074; 'Input data' of applicant is illustrated by 'inputs' of data of Nugent.) and increasing network activity within said artificial physical neural network until said at least one output changes to a desired output. (**Nugent,** ¶0074; 'Increasing network activity of applicant is accomplished by the 'amplifier' which provides feedback and selectively strengthens connections of Nugent.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy, Nagahara and Kaler by having the ability to input data as taught by Nugent to present presenting an input data set to said artificial physical neural network to produce at least one output thereof and increasing network activity within said artificial physical neural network until said at least one output changes to a desired output.

For the purpose of being able to use the physical neural network.

Claim 14

McHardy, Nagahara and Kaler do not teach increasing a number of firing neurons in said artificial, physical neural network.

Nugent teaches increasing a number of firing neurons in said artificial, physical neural network. (**Nugent,** ¶0074, ¶0075; 'Increasing network activity of applicant is accomplished by the 'amplifier' which provides feedback and selectively

strengthens connections of Nugent. 'Increasing a number of firings' of applicant is accomplished by the op-amp of Nugent.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy, Nagahara and Kaler by increasing firings as taught by Nugent to have increasing a number of firing neurons in said artificial, physical neural network.

For the purpose of training the adaptive physical neural network.

Claim 15

McHardy teaches said plurality of neurons comprises a plurality of interconnected neurons that are interconnected by said nanoconnections among said plurality of nanoconnections, each of said nanoconnections among said plurality of nanoconnections being associated with a weight (**McHardy,** C1:7-11; 'Plurality of neurons' and 'interconnected neurons of applicant is equivalent to 'neural network' of McHardy. 'Associated with a weight' of applicant is equivalent to 'adjustable weights' of McHardy.); and said increasing said network activity within said physical neural network includes scaling a weight associated with said nanoconnections by a positive factor. (**McHardy,** C2:55-65; 'Positive factor' of applicant is equivalent to 'increasing' of McHardy.)

Claim 16

McHardy, Nagahara and Kaler do not teach said plurality of neurons comprises a plurality of interconnected neurons that are interconnected by nanoconnections among said plurality of nanoconnections for transferring signals having a magnitude in a firing state; and said increasing said network activity within said artificial physical neural network includes increasing said magnitude of said signal in said firing state.

Nugent teaches said plurality of neurons comprises a plurality of interconnected neurons that are interconnected by nanoconnections among said plurality of nanoconnections for transferring signals having a magnitude in a firing state (**Nugent,** Figure 11; Nugent illustrates a single neuron with an input and a output with the output having a magnitude of at least the threshold.); and said increasing said network activity within said artificial physical neural network includes increasing said magnitude of said signal in said firing state. (**Nugent,** abstract; Increasing the network activity can be accomplished a few ways. Two of them are increasing input or lowering the threshold. In either case more neurons will fire thus causing an increase in nanoparticles to align thus increasing magnitude.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy, Nagahara and Kaler by increasing transferred signals as taught by Nugent to have plurality of neurons comprises a plurality of interconnected neurons that are interconnected by nanoconnections among said plurality of nanoconnections for transferring signals having a magnitude in a firing state; and said increasing said

network activity within said artificial physical neural network includes increasing said magnitude of said signal in said firing state.

For the purpose of having an increased magnitude of the firing state.

Claim 17

McHardy, Nagahara and Kaler do not teach said plurality of neurons comprises a plurality of interconnected neurons that are interconnected by a plurality of data input neurons thereof adapted to receive respective external signals; said increasing said network activity within said artificial physical neural network includes increasing a magnitude of said respective external signals.

Nugent teaches said plurality of neurons comprises a plurality of interconnected neurons that are interconnected by a plurality of data input neurons thereof adapted to receive respective external signals (**Nugent,** abstract); said increasing said network activity within said artificial physical neural network includes increasing a magnitude of said respective external signals. (**Nugent,** abstract; Increasing the network activity can be accomplished a few ways. Two of them (examples of external signals) are increasing input or lowering the threshold. In either case more neurons will fire thus causing an increase in nanoparticles to align thus increasing magnitude.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy, Nagahara and Kaler by describing the basic components of a physical neural network as taught by Nugent to have a plurality of neurons comprises a plurality of interconnected neurons

that are interconnected by a plurality of data input neurons thereof adapted to receive respective external signals; said increasing said network activity within said artificial physical neural network includes increasing a magnitude of said respective external signals.

For the purpose of scaling neural network operations.

Claim 18

McHardy, Nagahara and Kaler do not teach said plurality of neurons comprises a plurality of interconnected neurons, each of said interconnected neurons being configured to fire when a corresponding excitation level thereof is greater than or equal to a threshold; and said increasing said network activity within said artificial physical neural network includes lowering said threshold.

Nugent teaches said plurality of neurons comprises a plurality of interconnected neurons, each of said interconnected neurons being configured to fire when a corresponding excitation level thereof is greater than or equal to a threshold(**Nugent,** abstract ; This is the defination of a neural network.); and said increasing said network activity within said artificial physical neural network includes lowering said threshold. (**Nugent,** Figure 11 ; This is simple logic. If the threshold is lowered then the neuron will fire at an increased rate.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy, Nagahara and Kaler by reciting basic threshold functions within a neural network as taught by Nugent to have a plurality of neurons

comprises a plurality of interconnected neurons, each of said interconnected neurons being configured to fire when a corresponding excitation level thereof is greater than or equal to a threshold; and said increasing said network activity within said artificial physical neural network includes lowering said threshold.

For the purpose of using the threshold for determining input data into classifications.

Claim 19

McHardy, Nagahara and Kaler do not teach determining said excitation level of at least one neuron of said plurality of neurons based on a weighted sum of input signals received over respective nanoconnections among said plurality of nanoconnections, said nanoconnections being associated with respective weights; and adjusting each of said weights when said at least one neuron of said plurality of neurons and a corresponding one of said others of said neurons fire within a prescribed time interval.

Nugent teaches determining said excitation level of at least one neuron of said plurality of neurons based on a weighted sum of input signals received over respective nanoconnections among said plurality of nanoconnections, said nanoconnections being associated with respective weights (**Nugent,** ¶0111; 'Determining said excitation level' of applicant is part of the 'learning process' of Nugent); and adjusting each of said weights when said at least one neuron of said plurality of neurons and a corresponding one of said others of said neurons fire within a prescribed time interval. (**Nugent,** ¶0111;

'Adjusting each of said weights' of applicant is equivalent to 'changing connection weights' of Nugent.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy, Nagahara and Kaler by reviewing the basic principles of a neural network as taught by Nugent to have determining said excitation level of at least one neuron of said plurality of neurons based on a weighted sum of input signals received over respective nanoconnections among said plurality of nanoconnections, said nanoconnections being associated with respective weights; and adjusting each of said weights when said at least one neuron of said plurality of neurons and a corresponding one of said others of said neurons fire within a prescribed time interval.

For the purpose of illustrating the basic outline of a physical neural network using nanoconnections.

Claim 20

McHardy, Nagahara and Kaler do not teach increasing said network activity within said artificial physical neural network in response to a signal.

Nugent teaches increasing said network activity within said artificial physical neural network in response to a signal. (**Nugent,** ¶0111; 'Increasing said network activity' of applicant is equivalent to 'inputting vector rows' of Nugent.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy, Nagahara and Kaler by illustrating the training of a physical neural network involves increasing the activity of the

neural network as taught by Nugent to have a increasing said network activity within said artificial physical neural network in response to a signal.

For the purpose of Training the neural network.

Claim 21

McHardy, Nagahara and Kaler do not teach providing said desired output data; and comparing said desired output data and said output to generate said signal in response if said desired output data is not equal to said output.

Nugent teaches providing said desired output data(**Nugent,** ¶0111; 'Providing said desired output data' of applicant is equivalent to 'instructor signals' of Nugent.); and comparing said desired output data and said output to generate said signal in response if said desired output data is not equal to said output. (**Nugent,** ¶0111; 'Comparing' is a component of the 'learning process' of a neural network of Nugent.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of McHardy, Nagahara and Kaler by using comparison for training the neural network as taught by Nugent to providing said desired output data; and comparing said desired output data and said output to generate said signal in response if said desired output data is not equal to said output.

For the purpose of having a method for training the physical adaptive neural network.

Response to Arguments

5. Applicant's arguments filed on September 29, 2006 for claims 1-3, 6, 7, 9-21, 23, 24 have been fully considered but are not persuasive.

6. In reference to the Applicant's argument:

Claim Rejections 35 U.S.C. § 102

Requirements for Prima Fade Anticipation

A general definition of prima facie unpatentability is provided at 37 C.F.R. §1.56(b)(2)(ii):

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability. (emphasis added)

"Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration." W.L. Gore & Associates v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303, 313 (Fed. Cir. 1983) (citing Soundscriber Corp. v. United States, 360 F.2d 954, 960, 148 USPQ 298, 301 (Ct. Cl.), adopted, 149 USPQ 640 (Ct. Cl. 1966)), cert. denied, 469 U.S. 851 (1984). Thus, to anticipate the applicants' claims, the reference cited by the Examiner must disclose each element recited therein. "There must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention." Scripps Clinic & Research Foundation v. Genentech, Inc., 927 F.2d 1565, 18 USPQ 2d 1001, 1010 (Fed. Cir. 1991).

To overcome the anticipation rejection, the Applicant needs to only demonstrate that not all elements of a prima facie case of anticipation have beenmet, i.e., show that the prior art reference cited by the Examiner fails to disclose every element in each of the applicants' claims. "If the examination at the initial state does not produce a prima face case of unpatentability, then without more the applicant is entitled to grant of the patent." In re Oetiker, 977 F.2d 1443, 24 USPQ 2d 1443, 1444 (Fed. Cir. 1992).

Examiner's response:

McHardy is used to introduce a physical neural network with connection that can be made using an electrical field to induce the 'metallic whisker'. Nagahara is introduced that connections can be made using nanoparticles using an electric field to induce the connection. Kaler is introduced to illustrate that by varying the electrical field alters the nanoparticle characteristics. And Nugent is introduced to clean up the lose ends of making and using a neural network with nanoparticles suspended in solution. Office Action applies.

7. In reference to the Applicant's argument:

Nagahara
Claims 1, 2, 3, 6, and 7 were rejected by the Examiner under 35 U.S.C. 102(b) as being anticipated by Nagahara, "Direct Placement of Suspended Carbon Nanometer-scale Assembly" hereinafter referred to a Nagahara.

Applicant notes that Nagahara provides no teaching of a neural network and/or an artificial physical neural network as taught by Applicant's invention. Nagahara also does not provide for any teaching of a synapse or other such neural network components as taught by Applicant's invention. The mere presence of electrodes and carbon nanotubes as taught by Nagahara does not result in the anticipation of an artificial physical neural network as taught by Applicant's invention, including neural network components such as neuron.

Simply because Nagahara teaches electrodes does not mean that such electrodes are components of a neural network. There is no teaching of a neuron in Nagahara or of neural network activity or of synapses and other such neural network components and activity. Nagahara does not provide for any teaching of a neural network of any sort. Nagahara also does not provide for a teaching of a dielectric liquid as taught by Applicant's invention and a neural network based on neural network connections formed from nanoconductors disposed and free to move about within a dielectric liquid.

In order to anticipate claims 1, 3, 4, 6, and 7, Nagahara must actually disclose an artificial physical neural network and a dielectric liquid. The Applicant respectfully requests that the Examiner identify which specific components of Nagahara disclose an artificial_ and physical, neural network as taught by Applicant's invention, Because Nagahara does not actually disclose any types of neural networks based on neural network components disposed and free to move about within a dielectric liquid, Nagahara can not anticipate claims 1, 3, 4, 6, and 7.

Nagahara therefore does not anticipate claims 1, 2, 3, 6 and 7 under 35 U.S.C. 102(b). Applicant respectfully requests withdrawal of the rejection to claims 1, 2, 3, 6 and 7 based on Nagahara.

Examiner's response:

McHardy illustrates a physical neural network. Nagahara illustrates the nanoparticle component of the invention. (see section 6. of this Office Action) 'Dielectric liquid' of applicant is equivalent to 'dielectric constant of the solution medium' of Nagahara. Nanoparticles which are in a solution medium are free to move about due to the fact the solution medium is not frozen. Office Action applies.

8. In reference to the Applicant's argument:

III. Claim Rejections — 35 U.S.C. § 103

Requirements for Prima Facie Obviousness

The obligation of the examiner to go forward and produce reasoning and evidence in support of obviousness is clearly defined at M.P.E.P. §2142:

The examiner bears the initial burden of factually supporting any prima facie conclusion of obviousness. If the examiner does not produce a prima facie case, the applicant is under no obligation to submit evidence of nonobviousness.

M.P.E.P. §2143 sets out the three basic criteria that a patent examiner must satisfy to establish a prima facie case of obviousness:

some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;

a reasonable expectation of success; and

the teaching or suggestion of all the claim limitations by the prior art reference (or references when combined).

It follows that in the absence of such a prima facie showing of obviousness by the Examiner (assuming there are no objections or other grounds for rejection), an applicant is entitled to grant of a patent. In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443 (Fed. Cir. 1992). Thus, in order to support an obviousness rejection, the Examiner is obliged to produce evidence compelling a conclusion that each of the three aforementioned basic criteria has been met.

Examiner's response:

The combination of McHardy, Nagahara and Kaler is explained in section 6. Nugent reads much closer to the invention but the Examiner wanted to demonstrate that others(art references) had the idea before applicant. Office Action applies.

9. In reference to the Applicant's argument:

Nagahara in view of Mehrotra

Claims 5 and 8 were rejected by the Examiner under 35 U.S.C. 103(a) as being unpatentable over Nagahara, as set forth above, in view of Mehrotra, "Elements of Artificial Neural Networks").

The Applicant notes that claims 5 and 8 have been cancelled by amendment as indicated herein. Therefore, the Examiner's arguments with respect to claims 5 and 8 are rendered moot.

Nagahara, Mehrotra, Olson

Claims 9 and 10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahara in view of Mehrotra, and further in view of Olson "Startup Combines Nanotechnology With Neural Nets".

Regarding claims 9 and 10, the Applicant notes again that Nagahara provides no teaching or hint of a neural network and neural network components such as synapses and electrodes. Nagahara also does not provide for any teaching of neural network activity via neural network devices such as synapses and neurons. Additionally, as indicated above, Nagahara does not provide for any teaching of a dielectric liquid.

Regarding the Olson reference, the Applicant conceived of the subject matter of Olson to the extent this novel concept may be claimed in claims 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22.

The Applicant submits again herewith a declaration by Alex Nugent (hereinafter referred to as the "Nugent declaration") to antedate the effective dateof September 18, 2002 of the Olson reference, in accordance with 37 C.F.R. §1.131(a). The Examiner indicated that the prior declaration was improper. In order to correct any deficiencies that may have been present in the previously submitted declaration, Applicant is submitted an updated declaration (again, referred to as the "Nugent declaration").

The Nugent declaration is accompanied by Exhibit A forming part thereof that evidences both conception of the invention by Applicant prior to the effective date of September 18, 2002 of the Olson reference.

Exhibit A of the Nugent declaration provides copies of U.S. published Patent Application No. US20030177450 (i.e., U.S. Patent Application No. 10/095,273 filed on March 12, 2002) and U.S. Patent No. 6,889,216. These patent documents establish conception and constructive reduction to practice of the key element of the Olson invention prior to the effective date of September 18, 200 of the Olson reference. U.S. Patent Application Serial No. 10/095,273 discloses a technique of self-assembly to form connections in a dielectric solution, where electrical fields

can be used to strengthen or weaken certain connections for use in dense and sophisticated arrays of neural "synapse" connections, which is the same technique/system described in the Olson reference.

U.S. Patent No. 6,889,216 is the issued version of the patent application of U.S. published Patent Application No. US20030177450. The patent application and patent shown in Exhibit A establish conception and constructive reduction to practice (via filing of the application) prior to the effective date of September 18, 2002 of the Olson reference. That is, U.S. Patent Application Serial No. 10/095,273 was filed on March 12, 2002, which is before the effective date of September 18, 200 of the Olson reference. Reduction to practice (and hence conception) are established as of the filing date of the application.

The Nugent declaration also includes Exhibit B, which evidences Applicant's ownership of KnowmTech, LLC. The Applicant submits that "KnowmTech, LLC" is actually the company referred to incorrectly as "LowmTech" by the Olson reference. The Applicant believes that the author of the Olson reference incorrectly referred to Applicant's company "KnowmTech, LLC" as "LowmTech, LLC". The Applicant believes that this was merely a spelling mistake on the part of the author of the Olson reference. Exhibit B contains some of the "Limited Liability Company" document for KnowmTech, LLC that were prepared and filed with the State of New Mexico in 2002. A review of these documents indicates that Alex Nugent is a co-owner and the President of KnowmTech, LLC, which is the owner and assignee of U.S. published Patent Application No. US20030177450 (i.e., U.S. Patent Application No. 10/095,273 filed on March 12, 2002) and U.S. Patent No. 6,889,216 shown in Exhibit A of the Nugent declaration.

Therefore, given the Nugent declaration and Exhibits A and B thereof, important subject matter of claims 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 that distinguishes Applicant's claimed invention over the cited art, was conceived and reduced to practice via a patent filing by Applicant prior to the effective date of September 18, 2002 of the Olson reference. Therefore, Olson cannot be used to obviate claims 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22. Applicant respectfully requests that the rejection to claim 9 (and claims 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22) be withdrawn.

Nagahara, Mehrotra, Olson, Tapang

Claims 11 and 12 were rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Nagahara, Mehrotra, and Olson, as set forth above, and further in view of Tapang (U.S. Patent No. 4,926,064).

Applicant notes that the arguments presented above against the rejection to claims 9 and 10 apply equally against the rejection to claims 11 and 12. Based on the foregoing, the Applicant submits that the rejection to claims 11 and 12 has been conduct an interview in an effort to expedite prosecution in connection with the present application.

Examiner's response:

Mehrotra, Olson, Tapang are not used as art in this Office Action. Office Action stands.

Examination Considerations

10. The claims and only the claims form the metes and bounds of the invention. "Office personnel are to give the claims their broadest reasonable interpretation in light of the supporting disclosure. *In re Morris*, 127 F.3d 1048, 1054-55, 44USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim are not read into the claim. *In re Prater*, 415 F.2d, 1393, 1404-05, 162 USPQ 541, 550-551 (CCPA 1969)" (MPEP p 2100-8, c 2, l 45-48; p 2100-9, c 1, l 1-4). The Examiner has the full latitude to interpret each claim in the broadest reasonable sense. Examiner will reference prior art using terminology familiar to one of ordinary skill in the art. Such an approach is broad in concept and can be either explicit or implicit in meaning.

11. Examiner's Notes are provided to assist the applicant to better understand the nature of the prior art, application of such prior art and, as appropriate, to further indicate other prior art that maybe applied in other office actions. Such comments are entirely consistent with the intent and sprit of compact prosecution. However, and unless otherwise stated, the Examiner's Notes are not prior art but link to prior art that one of ordinary skill in the art would find inherently appropriate.

12. Examiner's Opinion: Paragraphs 10 and 11 apply. The Examiner has full latitude to interpret each claim in the broadest reasonable sense.

13. Claims 1-3, 6, 7, 9-21, 23, 24 are rejected.

Correspondence Information

14. Any inquiry concerning this information or related to the subject disclosure should be directed to the Examiner Peter Coughlan, whose telephone number is (571) 272-5990. The Examiner can be reached on Monday through Friday from 7:15 a.m. to 3:45 p.m.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor David Vincent can be reached at (571) 272-3687. Any response to this office action should be mailed to:

Commissioner of Patents and Trademarks,

Washington, D. C. 20231;

Hand delivered to:

Receptionist,

Customer Service Window,

Randolph Building,

401 Dulany Street,

Alexandria, Virginia 22313,

(located on the first floor of the south side of the Randolph Building);

or faxed to:

(571) 273-8300 (for formal communications intended for entry.)

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have any questions on access to Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

Peter Coughlan

11/17/2006

JOSEPH P HIRL
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